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Secular changes in the frequency of meteorological conditions favourable for sea surges along the east coast of Britain - bringing an earlier study up-to-date

INTRODUCTION

In 1965, G. R. R. Benwell studied the long term trends in meteorological conditions favourable for storm surges along the east coast of Britain using data from the years 1872-1962. This study attempts to bring that work up-to-date by including data up to April 1970.

DEFINITION

Clearly for this work to be of any use, the same definition for a meteorological condition favourable for a surge as was used by Benwell had to be used here. It was

"Any occasion when, on the morning chart of the DWR series (this being the 0600GMT chart over recent years) the geostrophic wind measured over an area of 200 nautical miles square centred above either point A (53°N 02°E), has a direction in the sector north-west to east through north and reaches at least 40 knots; or point B (57°N 01°W), has a direction in the sector north-west to north-east through north and reaches at least 40 knots, will be regarded as an occasion when meteorological conditions favoured a sea surge on the east coast."

It was found that this definition, although far from covering every surge which occurred, was at least adequate.

DATA EXTRACTION

In extracting data, it was attempted to emulate the conditions of Benwell's study completely, these being:-

a) when there was an airstream of correct specification about point A or B, but with A or B near the edge of but within the stream, this occasion was included. If similar conditions prevailed, but A or B just outside the stream, then this was excluded.

b) when a depression was less than 100nm from point A or B and thereby affected the evaluation of the mean wind, then this occasion was included.

However, on most days the definition could be applied without difficulty.

Data from January to April and from September to December of each year was used as this coincided with the Storm Tide Warning Service season.

RESULTS

Three figures produced in Benwell's paper are reproduced here with the extra results added. Figure(a) shows seasonal totals and ten year running means for all occasions when favourable conditions existed; figure (b) shows all occasions when favourable conditions existed and geostrophic wind strengths were greater than 50kts, and figure (c) all 'events' when favourable conditions existed, an 'event' being an independent occasion (a number of consecutive days satisfying the definition counting as one event).

Figures(c) and (b) both show fluctuations which, on performing a χ^2 test on the fourteen seven season period totals 1872-1969, are insignificant, the inclusion of the most recent eight seasons not making it any more possible to say anything useful about the variations from the long term mean. (For occasions with 50kts or more, the value of χ^2 arrived at was 9.3, and for events it was 15.8 - the 5% significance value of χ^2 with 13 degrees of freedom is 22.4.)

Figure (a) was shown by Benwell to contain differences from the long term mean which were significant to the 1% significance level performing a χ^2 test on the nine ten season period totals 1872-1961.

The last half-century tends to show a period of low frequency of favourable conditions following the marked peak in the first decade of the century, a transition period with increasing frequency in the late 1930's and early 1940's. and finally a period of above long term (98 year) mean frequency up to the present day.

It would seem from the figure that the last decade has exhibited a plateau of fairly high frequency rather than a clearly defined peak as was the case some 60 years previously. It must be stated, however, that it would be most unwise to use these results for predictive purposes as there is still far from enough data.

CONCLUSION

There is no indication that there has been a tendency for favourable meteorological conditions for surges on the east coast to have increased over the last few years, although the frequency remains above the long term average.

REFERENCE

Benwell G. R. R. Met O 11 Technical Note No. 21.

APPENDIX

Occasions Selected

a, b indicates definition satisfied at point A, B respectively with speed> 40kts, but 50kts.

A, B, indicates definition satisfied at point A, B respectively with speed > 50kts.

1963 Jan 19 a ; Jan 26 a ; March 12 a ;
April 6 a ; April 7 a ; Oct 14 b ;
Dec 19 b ;

1964 March 26 a ; April 4 a ; Sept 17 b ;
Oct 16 a ; Dec 3 b ; Dec 4 aB ;

1965 Jan 14 B ; Feb 13 B ; Feb 14 AB ;
April 18 a ; Sept 18 B ; Sept 29 b ;
Nov 2 b ; Nov 24 A ; Nov 26 aB ; Nov 28 b ;
Nov 30 B ; Dec 1 a ; Dec 10 AB ; Dec 27 b ; Sept 9 b ;

1966 March 12 b ; March 24 b ; March 25 a ; March 28 ab ;
March 29 b ; Sept 15 b ; Nov 16 AB ; Nov 17 ab ;
Nov 30 B ; Dec 2 b ; Dec 18 B ; Dec 24 b ;
Dec 25 a ;

1967 Jan 1 b ; Jan 2 B ; Jan 3 b ; Feb 4 b ;
Feb 23 B ; March 18 b ; March 19 b ; April 5 b ;
April 6 aB ; April 10 a ; April 20 b ;
Oct 18 ab ; Oct 29 b ; Nov 5 B ; Nov 6 b ;
Nov 12 b ; Dec 5 b ; Dec 7 aB ; Dec 29 B ;

1968 Jan 24 b ; March 6 aB ; April 3 b ; April 4 b ;
Nov 1 b ; Nov 3 a ; Dec 23 b ; Dec 27 b ;

1969 Feb 2 B ; Feb 7 b ; Feb 8 b ;
Sept 22 b ; Oct 1 b ; Nov 17 A ; Nov 28 ab ;
Nov 29 B ; Oct 29 b ;

1970 Feb 20 b ; March 2 b ; March 27 B ; March 19 ab ;
April 1 b ; April 29 b ;

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Figure (a)

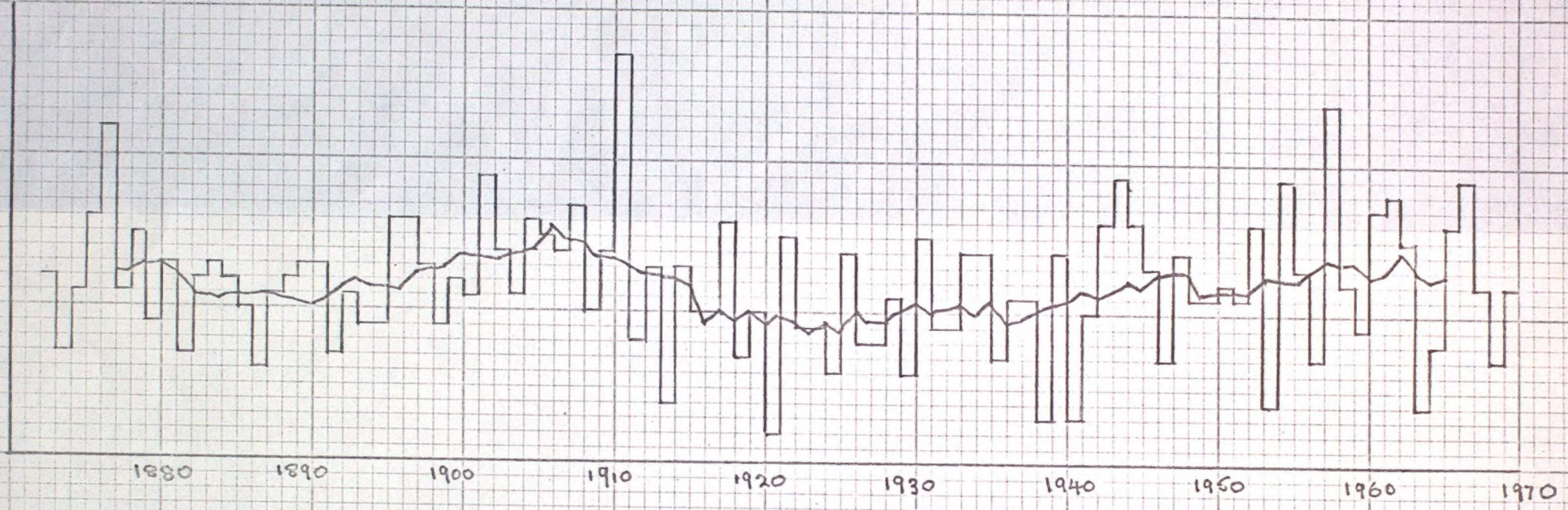

Figure (b)

Seasonal totals and 10 year running means for

a) all occasions on which favourable meteorological conditions existed

b) " " " " " " " " and wind strengths were ≥ 50 kts.

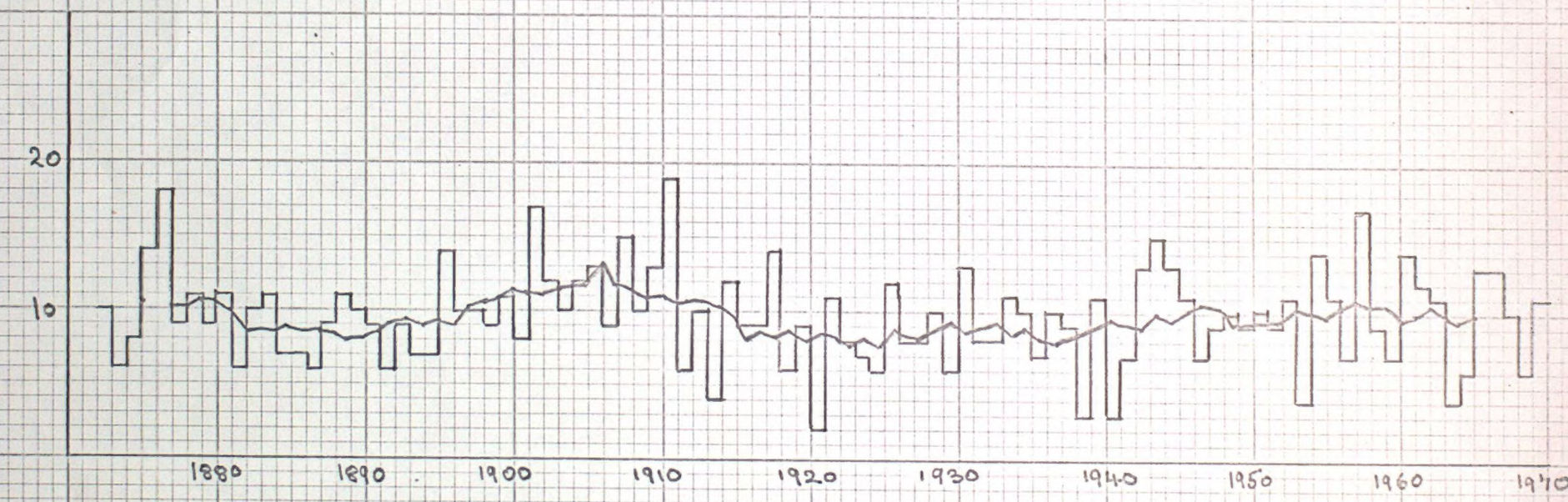

Figure (c) Seasonal totals and 10 year running means for
(a) events when favourable meteorological conditions existed